

**Summary of the results of the review of salmon
escapement goals for the Alaska Peninsula and
Aleutian Islands Management Areas (Area M), 2006**

by

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and

J. J. Hasbrouck

December 2008

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Symbols and Abbreviations

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Weights and measures (metric)		General		Measures (fisheries)	
centimeter	cm	Alaska Administrative		fork length	FL
deciliter	dL	Code	AAC	mideye to fork	MEF
gram	g	all commonly accepted		mideye to tail fork	METF
hectare	ha	abbreviations	e.g., Mr., Mrs., AM, PM, etc.	standard length	SL
kilogram	kg			total length	TL
kilometer	km	all commonly accepted			
liter	L	professional titles	e.g., Dr., Ph.D., R.N., etc.	Mathematics, statistics	
meter	m			<i>all standard mathematical</i>	
milliliter	mL	at	@	<i>signs, symbols and</i>	
millimeter	mm	compass directions:		<i>abbreviations</i>	
		east	E	alternate hypothesis	H _A
		north	N	base of natural logarithm	<i>e</i>
		south	S	catch per unit effort	CPUE
		west	W	coefficient of variation	CV
		copyright	©	common test statistics	(F, t, χ^2 , etc.)
		corporate suffixes:		confidence interval	CI
		Company	Co.	correlation coefficient	
		Corporation	Corp.	(multiple)	R
		Incorporated	Inc.	correlation coefficient	
		Limited	Ltd.	(simple)	r
		District of Columbia	D.C.	covariance	cov
		et alii (and others)	et al.	degree (angular)	°
		et cetera (and so forth)	etc.	degrees of freedom	df
		exempli gratia		expected value	<i>E</i>
		(for example)	e.g.	greater than	>
		Federal Information		greater than or equal to	≥
		Code	FIC	harvest per unit effort	HPUE
		id est (that is)	i.e.	less than	<
		latitude or longitude	lat. or long.	less than or equal to	≤
		monetary symbols		logarithm (natural)	ln
		(U.S.)	\$, ¢	logarithm (base 10)	log
		months (tables and		logarithm (specify base)	log ₂ , etc.
		figures): first three		minute (angular)	'
		letters	Jan,...,Dec	not significant	NS
		registered trademark	®	null hypothesis	H ₀
		trademark	™	percent	%
		United States		probability	P
		(adjective)	U.S.	probability of a type I error	
		United States of		(rejection of the null	
		America (noun)	USA	hypothesis when true)	α
		U.S.C.	United States	probability of a type II error	
			Code	(acceptance of the null	
		U.S. state	use two-letter	hypothesis when false)	β
			abbreviations	second (angular)	"
			(e.g., AK, WA)	standard deviation	SD
				standard error	SE
				variance	
				population	Var
				sample	var
Weights and measures (English)					
cubic feet per second	ft ³ /s				
foot	ft				
gallon	gal				
inch	in				
mile	mi				
nautical mile	nmi				
ounce	oz				
pound	lb				
quart	qt				
yard	yd				
Time and temperature					
day	d				
degrees Celsius	°C				
degrees Fahrenheit	°F				
degrees kelvin	K				
hour	h				
minute	min				
second	s				
Physics and chemistry					
all atomic symbols					
alternating current	AC				
ampere	A				
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity	pH				
(negative log of)					
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

REGIONAL INFORMATION REPORT. 4K08-8

**SUMMARY OF THE RESULTS OF THE REVIEW OF SALMON
ESCAPEMENT GOALS FOR THE ALASKA PENINSULA AND
ALEUTIAN ISLANDS MANAGEMENT AREAS (AREA M), 2006**

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TABLE OF CONTENTS

Memorandum: Area M Escapement Goal Recommendations, 2006

Page

1



ALASKA DEPARTMENT OF FISH AND GAME

*DIVISION OF COMMERCIAL FISHERIES
DIVISION OF SPORT FISH*

MEMORANDUM

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and
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Headquarters – Juneau

DATE: September 28, 2007

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SUBJECT: Area M salmon
escapement goal
recommendations

THRU: Jim McCullough
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Region IV – Kodiak

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Region IV – Kodiak
and
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The purpose of this memorandum is to provide a summary of the results of our review and our recommendations for salmon escapement goals for the Alaska Peninsula and Aleutian Islands Management Area (Area M).

In April 2006, an interdivisional team, including staff from the Divisions of Commercial Fisheries and Sport Fish, was formed to review existing salmon escapement goals in Area M. This review was based on the Policy for the Management of Sustainable Salmon Fisheries (SSFP; 5 AAC 39.222) and the Policy for Statewide Salmon Escapement Goals (5 AAC 39.223). This memorandum summarizes the results of the salmon escapement goal review and subsequent recommendations. The team reached consensus on all recommendations outlined below.

The SSFP also directs the department to identify any salmon stocks that, based on evaluation of the stock status, present a concern with respect to yield, management, or conservation. This information must be presented to the Alaska Board of Fisheries (Board) at regular meetings. The team determined no stocks in Area M warranted stock of concern status (Table 1).

The Area M salmon escapement goals were last reviewed by the department in 2003. That review resulted in changing 20 goals, eliminating 12 goals, and leaving 16 goals unchanged (Nelson et al. 2006). The review team determined the appropriate goal type [biological escapement goal (BEG) or sustainable escapement goal (SEG) as defined in the SSFP] for each Area M salmon stock with an existing goal, based on the quality and quantity of available data, and then determined the most appropriate methods to evaluate the escapement goal ranges. If a sufficient time series of escapement and total return estimates were available and the data contained sufficient information to provide a scientifically defensible, accurate estimate of the spawning escapement that had the greatest potential to produce maximum sustained yield (S_{msy}), then the data were considered sufficient to attempt to develop a BEG. If return estimates were not available and/or the data were not sufficient to estimate S_{msy} , the data were used to establish an SEG. Methods used to develop BEGs included spawner-recruit analysis and a habitat based model. Methods used to develop SEGs included the percentile approach, cluster analysis of count data, and limnological models.

For the current review, we examined stock assessment data for one North Peninsula Chinook salmon stock, four South Peninsula sockeye salmon stocks, 10 North Peninsula sockeye salmon stocks (includes early and late runs for Bear Lake sockeye salmon), one Aleutian Islands sockeye salmon stock, one South Peninsula coho salmon stock, one North Peninsula coho salmon stock, two South Peninsula pink salmon aggregate stocks, two North Peninsula pink salmon aggregate stocks, four South Peninsula chum salmon aggregate stocks, and two North Peninsula chum salmon aggregate stocks. We conducted our review similarly to the 2003 review, primarily updating previous analyses using stock assessment data from 2003 through 2005.

We did not review or analyze data for most stocks for which goals were eliminated in 2003. We reviewed the McLees Lake sockeye salmon stock data even though the goal was eliminated in 2003 because the U.S. Fish and Wildlife Service has operated a weir at this system the last several years and is interested in having the department develop an escapement goal if the data warrant one.

After analyzing available data for each stock, the team estimated escapement goals, compared these estimates with the current goal, and then made recommendations to maintain (no change), change, or eliminate the current goal. The methods used to evaluate Area M escapement goals as

well as the rationale used to make subsequent recommendations are described in detail in Honnold et al. (*in press*).

The team proposes the following recommendations, which were presented to the Board and the public at the February 2007 Alaska Peninsula and Aleutian Islands Board meeting. Current Area M salmon escapement goals, escapements from 2003 through 2005, and the team's recommendations are presented in Table 1.

Chinook salmon

The team recommends that the current Nelson River Chinook salmon BEG of 2,400 to 4,400, as established in 2003, should remain unchanged. When a spawner-recruit analysis (Ricker 1954) was conducted, which included additional data available for this review, the results did not change significantly.

Sockeye salmon

Of the 14 Area M sockeye salmon escapement goals, the team recommends that nine should remain unchanged, four goals should be changed, and one goal should be eliminated.

The current Swanson Lagoon SEG range of 8,000 to 16,000 sockeye salmon should be changed to an SEG range of 6,000 to 16,000 based on a percentile analysis (Bue and Hasbrouck *unpublished*) using data from 1990, when the current goal was established, through 2005. The percentile method results (high contrast escapement data, low exploitation of the stock, 15th to 75th percentiles) indicated the lower range of the goal should be decreased with the upper range remaining unchanged.

The current Sandy River sockeye salmon SEG range of 40,000 to 60,000 should be changed to an SEG range of 34,000 to 74,000 following evaluation of escapement data using the percentile method (Bue and Hasbrouck *unpublished*). A risk analysis was also conducted to ensure that the lower range of this goal is acceptable in terms of minimizing the risk of triggering a management concern (Bernard et al. *unpublished*). The escapement goal was not changed during the last escapement goal review due to low contrast in the weir count data, limnology data (although limited) that did not support higher escapements into the lake, and because the goal had been providing for desired escapements as well as surplus production (Nelson et al. 2006). During our review, after adjusting the aerial surveys and combining them with the weir counts, the increased escapement data provided greater contrast, resulting in a wider SEG range.

The current Meshik River SEG range of 10,000 to 20,000 sockeye salmon should be changed to an SEG range of 20,000 to 60,000 based on a percentile analysis (Bue and Hasbrouck *unpublished*) using data from 1990 to 2005. Fishery management changes have required increased aerial survey effort on Meshik River during the last 16 years (1990-2005). During this period of improved monitoring, escapement estimates have increased. These data (high contrast, low exploitation) better reflect the current escapement trends of the Meshik River stock; thus, our analysis supports a wider SEG range.

Cinder River's current SEG range of 6,000 to 12,000 sockeye salmon should be changed to an SEG range of 12,000 to 48,000 based on a percentile analysis (Bue and Hasbrouck *unpublished*)

using data from 1990 to 2005. In conjunction with the increased monitoring effort on the Meshik River, aerial surveys of Cinder River increased during 1990 to 2005. Our analysis of escapement data (high contrast, low exploitation) from this period better reflect recent Cinder River sockeye salmon escapement trends.

Finally, the sockeye salmon escapement goal for Middle Lagoon should be eliminated because of the lack of reliable escapement estimates; aerial survey conditions for this stock are difficult, resulting in inconsistent data collection and unreliable escapement estimates, and will likely not improve in the future. In addition, it is difficult to actively manage escapements in season at this system due to turbid water conditions in the lower portion of the system. A cluster analysis (Everitt et al. 2001) of escapement data suggested that escapement trends at Middle Lagoon are related to the escapement trends of Thin Point Lake sockeye salmon. Therefore, it seems reasonable to monitor the Middle Lagoon sockeye salmon stock using Thin Point Lake sockeye salmon escapement trends as a proxy.

After examining the McLees Lake sockeye salmon weir data and historical aerial survey data, the team decided there were insufficient data at this time to develop a goal. Assessment of this stock should continue, so that a goal could potentially be developed in the future.

Coho salmon

The team recommends that the current Thin Point Lake coho SEG of 3,000 and the current Nelson River coho salmon SEG of 18,000 remain unchanged. There is not any recent information that would warrant changing the current SEGs for these stocks.

Pink salmon

Four South Peninsula pink salmon escapement goals (even- and odd-year goals for two aggregate stocks) were evaluated during this review. The team recommends that the current South Peninsula pink salmon BEG ranges of 1,864,600 to 3,729,300 for even years and 1,637,800 to 3,275,700 for odd years be changed to SEGs with the same ranges. This recommendation is based on spawner-recruit analyses (Ricker 1954) using two additional years of data, which corroborated the current goal ranges. SEGs are recommended for these aggregates because escapement data were collected (and will continue to be collected) by aerial survey and provided indices of escapements rather than total escapement estimates, which are unknown.

The team also recommends the Bechevin Bay pink salmon SEG for even years (31,000) and the SEG for odd years (1,600) remain unchanged. These recommendations are based on risk analyses (Bernard et al. *unpublished*), which indicate that these goals should minimize the risk of triggering a management concern when the concern is not warranted.

There were no additional data for assessment of Unalaska pink salmon stocks. The team agreed that there is no need at this time to determine goals for Unalaska pink salmon stocks because they are rarely harvested and the previous SEGs were eliminated during the last escapement goal evaluation in 2003.

Chum salmon

Based on the results of percentile analyses (Bue and Hasbrouck *unpublished*), the team recommends that the current South Peninsula chum salmon SEG ranges of 106,400 to 212,800 for the Southeastern District, 89,800 to 179,600 for the South Central District, and 133,400 to

266,800 for the Southwestern District should remain unchanged,. The team recommends, as a result of a risk analysis (Bernard et al. *unpublished*), that the upper range (1,600) of the SEG for the Unimak District should be eliminated and the lower range should remain at 800. The risk analysis was used for this stock because there is little or no directed harvest on chum salmon from this area; chum salmon from the Unimak District are caught incidentally in other fisheries.

The team recommends changing the North Peninsula chum salmon escapement goals from BEGs to SEGs while keeping the ranges unchanged as follows: Northwestern District - SEG of 100,000 to 215,000, Northern District - SEG of 119,600 to 239,200. Similar to South Peninsula pink salmon, SEGs are recommended because escapements are indexed by aerial surveys and the accuracy of these surveys in indexing the entire escapement is unknown.

In summary, our comprehensive review of the 27 existing salmon escapement goals in Area M resulted in consensus to leave 17 goals unchanged, change five goals, reclassify four goals (from BEGs to SEGs), and eliminate one goal. This would result in 26 escapement goals for Area M including: one BEG for Chinook salmon, one BEG and 12 SEGs for sockeye salmon, two SEGs for coho salmon, four aggregate SEGs for pink salmon, and six aggregate SEGs for chum salmon. We do not expect these changes to have noticeable effects on future management decisions in Area M and, with your approval, we would like to implement these changes for the 2007 salmon season.

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Approval Signatures

John Hilsinger, Director, Division of Commercial Fisheries

Date

Charles Swanton, Director, Division of Sport Fish

Date

Table 1. Current escapement goals, escapements observed from 2003 through 2005, and escapement goal recommendations in 2006 for Chinook, sockeye, coho, pink, and chum salmon stocks of the Alaska Peninsula and Aleutian Islands Management Area.

System	Escapement Data ^a	Current Escapement Goal				Escapements			2006
		Type	Range			2003	2004	2005	Recommendation
		(BEG, SEG)							
Chinook Salmon									
Nelson River	WC	BEG	2,400	to	4,400	5,154	6,959	4,993	No change
Sockeye Salmon									
Orzinski Lake	WC	SEG	15,000	to	20,000	70,690	75,450	44,797	No change
Thin Point Lake	PAS	SEG	14,000	to	28,000	40,000	34,500	21,000	No change
Mortensens Lagoon	PAS	SEG	3,200	to	6,400	16,804	7,215	21,703	No change
Middle Lagoon	PAS	SEG	16,000	to	32,000	27,300	39,400	7,000	Eliminate
Christianson Lagoon	PAS	SEG	25,000	to	50,000	52,200	75,400	54,500	No change
Swanson Lagoon	PAS	SEG	8,000	to	16,000	16,100	24,300	3,500	Change: SEG: 6,000-16,000
North Creek	PAS	SEG	4,400	to	8,800	10,200	15,000	45,000	No change
Nelson River	WC	BEG	97,000	to	219,000	343,511	480,097	303,000	No change
Bear Lake									
Early	WC	SEG	176,000	to	293,000	226,201	354,565	332,248	No change
Late	WC	SEG	117,000	to	195,000	139,799	80,435	221,752	No change
Total	WC	SEG	293,000	to	488,000	366,000	435,000	554,000	No change
Sandy River	WC	SEG	40,000	to	60,000	66,000	32,000	101,000	Change: SEG 34,000-74,000
Ilnik River	WC	SEG	40,000	to	60,000	69,000	82,000	154,000	No change
Meshik River	PAS	SEG	10,000	to	20,000	94,000	82,200	96,100	Change: SEG 20,000 - 60,000
Cinder River	PAS	SEG	6,000	to	12,000	88,700	55,050	96,000	Change: SEG 12,000 - 48,000
McLees Lake	WC/PAS	none				101,793	40,328	12,097	No change
Coho Salmon									
Thin Point Lake	PAS	SEG	3,000			25,000	9,600	17,500	No change
Nelson River	PAS	SEG	18,000			28,000	52,500	24,000	No change

-Continued-

Table 1. (Page 2 of 2)

System	Escapement Data ^a	Escapement Goal				Escapements			2006 Recommendation
		Type (BEG, SEG)	Range		2003	2004	2005		
Pink Salmon									
South Peninsula Total -even years	PAS	BEG	1,864,600	to	3,729,300		8,311,410		Reclassify as SEG
South Peninsula Total -odd years	PAS	BEG	1,637,800	to	3,275,700	5,511,220		6,165,634	Reclassify as SEG
Bechevin Bay Section-even years	PAS	SEG	31,000				84,300		No change
Bechevin Bay Section-odd years	PAS	SEG	1,600			800		8,720	No change
Chum Salmon									
Southeastern District	PAS	SEG	106,400	to	212,800	218,810	367,200	412,500	No change
South Central District	PAS	SEG	89,800	to	179,600	79,000	184,800	235,700	No change
Southwestern District	PAS	SEG	133,400	to	266,800	193,030	180,000	317,910	No change
Unimak District	PAS	SEG	800	to	1,600	200	400	4,200	Change: SEG: 800
Northwestern District	PAS	BEG	100,000	to	215,000	236,000	295,600	192,965	Reclassify as SEG
Northern District	PAS	BEG	119,600	to	239,200	214,660	139,350	103,675	Reclassify as SEG

^a PAS = Peak Aerial Survey, WC= Weir Count.